General Dynamics Amphibious Systems
14041 Worth Avenue,
Woodbridge, VA 22192

Environmental Excellence (E-2) Status
First Annual Report
February 26, 2003

Prepared by Joseph R. Finch,
Environmental Engineer,
General Dynamics Amphibious Systems,
(703) 492-6022

PURPOSE

General Dynamics Amphibious Systems has developed a first-class operation to design and build a new class of amphibious vehicles for the US Marine Corps. This report highlights some of the conspicuously innovative concepts implemented by this program to ensure high standards of compliance with environmental and pollution prevention laws.

AAAV OVERVIEW

The Advanced Amphibious Assault Vehicle (AAAV) is a self-deploying, high water speed, fully tracked, armored amphibious assault personnel carrier. The vehicle carries 17 combat equipped Marines and has a crew of three. The AAAVs land mobility is equivalent to that of the M1A1 Main Battle Tank (MBT), achieving a speed of 48 miles per hour on land. In the high water speed mode, the AAAV can plane over the water at speeds in excess of 20 knots.

The Direct Reporting Program Manager, Advanced Amphibious Assault (DRPM AAA) is responsible for the design, development, test, procurement, fielding, and life cycle support of the AAAV.

The AAAV is in the early in design and development phase, specifically System Design and Development. Low-Rate Initial Production is not expected until 2005. Full-Rate Production will occur in 2006.

As of December 2002, General Dynamics has two facilities in Woodbridge Virginia; an Advance Amphibious Assault Vehicle Technology Annex at 991 Annapolis Way, and a Worth Avenue Technology Center at 14041 Worth Avenue. At the Annapolis Way Annex the basic design of the vehicle was proven through three prototypes designed and built during 1997 – 2001.

ORIGINALITY AND PUBLIC PURPOSE

- The DRPM AAA has made environmental protection, including an Ozone Depleting Substance (ODS)-free AAAV design, an integral consideration in all its acquisition processes. The DRPM AAA mandated that the design of the AAAV be done *correctly* "the first time" and continue doing it right *early* in its development cycle. The DRPM AAA made a conscious decision that no Class I or II ODS will be used in the design of the AAAV. This avoids damage to the environment and costly retrofitting. Even in the face of increasing schedule and performance constraints the AAAV program has continued to remain ODS free in design and maintenance. Maintenance and shop floor areas are spot checked to ensure all products used for the program and for the facilities are ODS free. The environmental engineer approves all Material Requests, each critical item development specification and each engineering drawing to ensure all parts are compliant. Environmental, Safety, and Health personnel and the Materials engineer carefully review each potential product before it is approved for use in the program. All procurement personnel have been educated on products that may contain ODS chemicals. Procurement personnel will not approve material requests for any product containing an ODS. While this review process takes a little more time, it is more environmentally responsible, and results in a cleaner environment.

- During the selection process for the design and development contract of the AAAV, the DRPM AAA included specific evaluation criteria on environmental protection. Each offeror was required to submit a Pollution Prevention Plan in response to the Request For Proposal, which described how the offeror would provide environmental protection. A critical aspect of source selection for all products was a product line free of Class I and II ODS.

- The use of the Environmental Protection Agency (EPA) top 17 hazardous materials has been minimized in the AAAV design, manufacturing processes, and repair procedures. This design requirement has been applied to all components in the AAAV, and has been communicated to each vendor and sub contractor as a condition of their participation in the AAAV program. The design contractor, General Dynamics Amphibious Systems (GDAMS), and all subcontractors and vendors must modify their components and production processes to eliminate the use of ODS and other hazardous materials to comply with the Design Specification. The AAAV program's influence has been extended to other programs through dialogue, message traffic and publicity for environmental stewardship. Changes in production processes based on the AAAV Design Specification has benefited other Department of Defense (DoD) Program Managers since many programs utilize the same components.

- Design trade studies for the AAAV include environmental protection as a design selection criterion. This process insures the selection of the best design alternative while considering hazardous material minimization; ODS-free materials; and global warmer elimination. This has also proven to be a cost reduction measure as we select products that perform the task while minimizing disposal costs.

ACCOMPLISHMENTS

Presentation of Environmental Constraints

Perhaps the largest environmental accomplishment the company made is that each of 22 engineering design teams was briefed on the importance of an environmentally responsible design. This required 42 separate presentations in order to reach every one of the design engineers. As a result we raised the environmental consciousness of the entire program.

Review and Selection of Materials

Environmental, Safety, Materials and Industrial health Engineers carefully research each material selected for the AAAV program before the product is approved for use. This helps control materials and ensure we use products that will do the job with minimal damage to the environment, at reasonable cost, and with minimal disposal costs.
This single measure has resulted in significant cost-savings and cost avoidance because materials selected do not require specialized handling, involve health risks, or require elaborate disposal considerations. More importantly we are able to produce this major weapons system in an environmentally responsible manner. RCRA compliance, clean air compliance and clean water compliance are all simplified due to the environemntally responsible approach.

Parts Washer Selection

The AAAV program selected an environmentally friendly parts washer for facilities that will support the AAAV program, which will eventually be nation-wide in support of Marine Corps bases around the country. Each of the bio-degradable parts washers performs its task well and at a whopping savings over traditional solvent-based parts washers. Use of traditional solvent based parts washer systems requires replenishment of the solvents every one or two months depending on frequency of use, each replenishment costs about 320 dollars, (variable based on quantity needed and frequency of use,). The total amortization cost of a Bio-degradable parts washing application is about $320.00 per **year** with no monthly fee which is very low especially when considering life cycle costs. An estimate from another parts washer vendor was $230.00 per month. The environmentally sound approach requires no monthly fee for a disposal contractor to come to the facility and remove hazardous and toxic wastes. There is no fire risk, no risk of a toxic or hazardous spill with expensive clean-up procedures, and it even saves us the cost of hand degreasing creams for our mechanics. We do not need to buy LAVA or other degreasing soaps for the Marine's hands, the Bio-degradable parts washer fluid will clean hands too. When considering only two facilities our cost savings are around $1,500 per year.

Re-formulations

A Virginia-based corporation who wanted to sell us one of their adhesive products, did not realize that one ingredient, Trichlorofluoropropane, is an ODS. During our review we found that ingredient and asked the company if it knew that the product was an ODS. The sales person said "No, I think we use only environmentally safe products". It was explained that Trichlorofluoropropane was listed as a type II ODS and we could not use the product because we must remain ODS free.

It was also explained to them that there are other chemicals that may be able to do the same task and are not ODS, and that if they would re-formulate the product we could reconsider it's use.

After 4 months of discussions and a few phone calls, they called on 9 July to inform us that their chemists had discovered that there is a lot of argument against use of ODS and they had decided to reformulate all their products effective December this 2002. He appreciated our candor and the fact we had suggested reformulation was possible.

Coordination with Test Sites

The AAAV program conscientiously coordinates and checks with each test site, locally and elsewhere in the country to ensure environmental, health and safety concerns are addressed with all stakeholders. We may not always make every group happy, but none can say we did not carefully consider their needs and concerns. So far there have been no surprises to any of the test sites concerning any aspect of this program. There have been no accidents or incidents that caused concern to a local community and no incident has occurred to alarm any community. The program looks at the chemistry of the vehicle in light of the restricted environments it will likely meet elsewhere in the country. A database has been developed and is tracking the total volume of chemicals that might be added to any given site in order to ensure we do not overburden a local area with a fresh water or clean air compliance issue. Additionally, the environmental engineer has presented briefings to the Department of Environmental Quality, the College of Civil and Environmental Engineering at Virginia Tech, the American Society of Naval Engineers, Auditors in training for the Department of Environmental Quality, and other groups concerning the development of this program. The consistent message is that this program wants to remain environmentally sound.

HAZMAT Management

The AAAV program has consistently required all Purchase orders to be approved by the environmental engineer as a measure of control on the purchase of products that meet the stringent environmental requirements of this program. General Dynamics Amphibious Systems also took steps in 2002 to tighten our hazardous materials management plan. We have re-written our contingency plans to include more detail about emergency equipment and emergency contacts. Additionally, we have invited the local Police and fire fighting personnel to each facility to familiarize them with locations of any product that might produce a toxic environment in a fire. This information is now posted at several locations within the facility. We have also trained a broader group of employees in hazardous waste management allowing greater effectiveness and efficiency.

Wastewater and Waste Stream Issues

We have virtually eliminated pollution from waste stream operations and we have reduced the risk of spill and contamination associated with these processes. The floors of our facilities are sealed so that no waste that falls on the floor can spill out to the environment. A series of spill containment kits are available around the shop floor to contain fluids in the event of an emergency. However the implementation of a "pharmacy concept" where technicians can only obtain the minimum necessary quantities, ensures that containers on the shop floor are sized to meet the need with little excess. This means that any spill will be very small; the largest quantity that can be spilled is about one gallon of fluid. We also have ongoing audits to reduce spill risks. We are currently looking at one wastestream that is disposed of off-site as mixed oily waste water to determine if we might be able to evaporate it on-site.

FUTURE GOALS

Environmental Management System

We continuously review our Environmental Policy and practices to see what improvements can be made to reduce cost and improve efficiency. We have a number of auditors from outside sources and a variety of visitors whose observations are folded into ongoing reviews. As an example, during the year 2002, the Virginia Department of Environmental quality asked if we would host a group of environmental auditors in training. During their visit, the environmental engineer asked each of them for at least one idea on how to improve the plant or processes they had toured. In all four of those student observations were integrated into our daily operations. We will continue to aggressively seek ways to better the operation of both General Dynamics Facilities in Woodbridge, VA.

Hazardous Waste

At this point our Woodbridge operations generate a very small quantity of waste and only a small percent is oily mixed waste water. We intend to scrutinize all our waste processes with an eye toward reduction.

Review of all Materials and Chemistry

Currently, the AAAV production process involves the use of 2,279 chemical substances. The first review of our chemistry reduced about 60 products involving approximately 130 chemicals. During 2003 we plan to conduct a top to bottom review of all the chemicals in an attempt to further simplify the chemistry of the AAAV.

Energy Consumption

In our Worth Avenue Facility we have learned there is an opportunity to reduce the heating requirements during the heating season and possibly a way to reduce the lighting requirements for the assembly line. We will investigate the possibility of reducing the costs of lighting and heating.